Entry Methods For Handheld Devices Or For AAC Writing System

Franck Poirier

Text Entry Methods For Handheld Devices Or For AAC Writing System

Franck Poirier
Lab-STICC
Université de Bretagne-Sud
Campus de Tohannic
56000 Vannes, France
franck.poirier@univ-ubs.fr

CHI'12, May 5–10, 2012, Austin, Texas, USA.
ACM 978-1-4503-1016-1/12/05.

Abstract
In this paper, we mention our past and current works in text entry. Since more than ten years, we have explored different approaches and proposed different text entry methods. Some are designed for use in mobility and other are specially intended for people with disabilities.

Author Keywords
Text entry, onscreen keyboard design, motor disabilities, word prediction.

ACM Classification Keywords
H.5.2 [**Information interfaces and presentation**]: User Interfaces - *Input Devices and Strategies, Interaction Styles*.
K.4.2 [**Computers and Society**]: Social Issues - *Assistive technologies for persons with disabilities.*

General Terms
Design, Performance, Experimentation, Human factors.

Introduction
It is difficult to summarize in less than four pages, all our research in text entry. Thus we will mainly explain the logic of the whole approach and introduce the principle of the proposed methods. Finally, we will try to draw some perspectives. For more details, refer to the original articles.

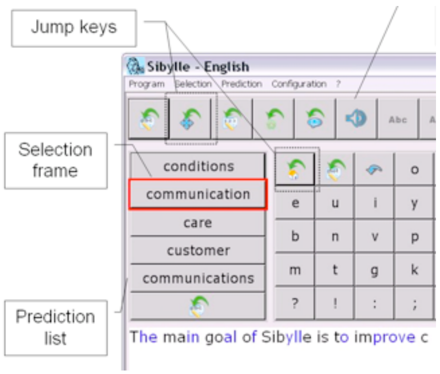

Figure 1. The user interface of SIBYLLE (English version).

Figure 2. Glyph: The 7-key keyboard (6 primitive keys and a command key).

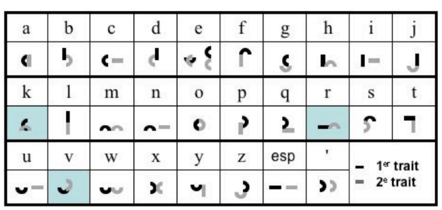

Figure 3. Glyph2 alphabet set for the letter mode.

At the beginning, a research on AAC system

Our first work on text entry has concerned Augmentative and Alternative Communication (AAC) system for persons who are not able to use standard input devices. From 2000, mainly with Jean-Yves Antoine, we have designed Sibylle [8] that permits persons with severe physical disabilities (cerebral palsy, locked-in syndrome…) to enter text with any computer application. The system consists of a virtual keyboard comprising a set of sub-keypads which allow entering characters or full words. The cursor successively highlights each key of the active keypad which can then be selected by a single-switch selection process (Figure 1). It also comprises a sophisticated letter and word prediction components which dynamically calculate the most appropriate letters or words for a given context. For the assessment, Sibylle is evaluated by an objective measure called Keystroke Saving Rate (ksr). The ksr is above 50% for all languages (French, German, English) and registers (literature, e-mail, news…). This means that more than half of the keystrokes are avoided for the user.

Text entry based on the structure of Roman characters

As a state of the art in French on text input methods for mobile devices with reduced interfaces didn't exist, we wrote one in 2005 [5] that proposed a typology and a comparison of input methods.

In the same time, when mobile devices (mobile phone, PDA, GPS…) began to be widely used, we tried to exploit our expertise in designing alternative text entry methods. Our first proposed text input method for handheld devices was Glyph [6]. Figure 2 shows the keypad where each trapezoidal key corresponds to a primitive shape. One character is decomposed into a sequence of one to three primitives according to a principle of analogy with Roman characters. We chose as primitives the horizontal and vertical strokes and the right, left, upwards and downwards curves.

Glyph has two main advantages. First, the analogy principle allows to easily recall in memory the primitive sequences. Secondly, the small number of primitives, combined with the gestural interaction, quickly leads to the construction of effective gestural routines for every character. The main drawback of Glyph is that the number of key presses by character is not fixed. It depends on its shape complexity (i.e. "I" is coded by one primitive, "J" by two and "k" by three).

In 2006, with Mohammed Belatar we tried to correct this problem by proposing a new method called Glyph2 [1]. Contrary to Glyph, each character is entered by exactly two key presses (Figure 3). The 6 primitive shapes of Glyph were unchanged. This 7-key keyboard is a kind of marking menu and allows three ways of entering primitive sequences: static input, dynamic input and expert dynamic input. Glyph2 makes the entry faster and less tiring than other comparable methods and particularly than Glyph. The two-primitive coding principle combined with the dynamic input mode asks for few motor and cognitive controls of the user.

In 2006, we still tried to simplify our text input. As we already use two symbols to encode a character, we have sought to use only one. It was a difficult challenge. This approach corresponds to the first conceivable case to the Wigdor's taxonomy [9] described as impossible. As Glyph and Glyph2,

Figure 4. The UniGlyph character set.

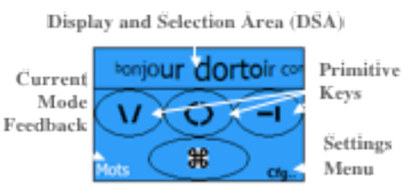

Figure 5. The UniGlyph keypad.

UniGlyph [7] is also based on the structure of Roman characters, but the set of primitive shapes are reduced to only 3 symbols: diagonal stroke, curve and horizontal or vertical line. Each letter is represented by only one primitive according to a simple rule (Figure 4). The UniGlyph keypad contains three shape keys and one command key used to jump to the different input modes (Figure 5). As there are many more characters than primitives, each primitive corresponds to a set of letters. The expected word is deduced by a linguistic predictor like for all the ambiguous keyboards (T9®, SureType®…). The theorical input rate based on Fitts' law predicts about 55 words per minute (wpm). Our comparative experiment has shown that UniGlyph input rate is higher and that the keystrokes per character (kspc) [4] is lower than other reduced-key text input methods. Depending on users, the input rate measured is ranging from 6 to 17 wpm and the mean kspc at the fifth session is 1.02 which shows that there is very few input errors.

Since the beginning, in our approach we searched to minimize the number of keys mainly for three reasons. First, in order to minimize the size of the onscreen keyboard and secondly, to improve the input speed on the basis of the Hick-Hyman's law and the Fitts' law, and thirdly, in order to easily adapt our methods to users with motor impairments.

The main approach for AAC writing system is the scanning keyboard. More complete is the keyboard, less efficient is the approach. With a 4-key reduced keyboard, the scanning approach may be very efficient. So we have decided to adapt UniGlyph for handheld users with severe motor impairments. The adapted method is called HandiGlyph [2].

HandiGlyph interface is built with three ambiguous primitive keys, a command key and two display areas. A regular scanning focus rotates past the three primitive keys and the command key. The user can, at anytime, enable the sensor in order to click on the highlighted key (Figure 6). After each click, the display area in the middle of the onscreen keyboard shows a list of words that we call "disambiguation list". The bottom display area shows a list of longer words called "completion list". The words shown on the two display areas are sorted by their occurrence frequency in the language. HandiGlyph uses different modes: letter, word, punctuation, command and configuration modes. For the Locked-In Syndrome person, the input rate is about 3 wpm but it is not very significant in this context. The user satisfaction is more important. Our reference user was captured by the novelty of HandiGlyph knowing that he used other AAC systems daily, he just said "wow, I want this system". He is "convinced" that it is a very fast text input solution compared to other usual scanning keyboards.

With Hamed Sad, we have developed a platform for mobile text entry methods evaluations to reduce the resources required for evaluation and to make it more reproducible and generalisable. We have also followed some original approaches based on scrolling with a tilt sensor or based on a pictographic keyboard.

Return to AAC writing systems

Actually, with Yohan Guerrier, who is a PhD with a cerebral palsy, Maxime Baas and Christophe Kolski, we have also proposed different keyboards dedicated to users with motor impairments [3] (Figure 7). The main objective of these keyboards is to reduce effort and consequently to increase the input speed.

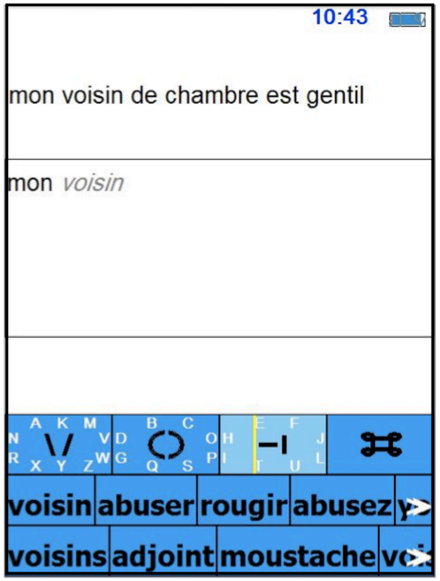

Figure 6. The HandiGlyph scanning keyboard with four keys and two display areas.

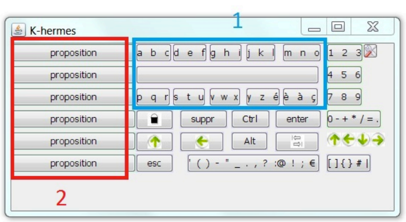

Figure 7. The K-Hermes scanning keyboard (1- ambiguous scanning keypad, 2- prediction keypad).

Questions and research perspectives

Despite the many virtual keyboards that have been developed over the past ten years, nowadays on mobile devices, the QWERTY keyboard is by far the most widely used. It's pretty sad when you think that this keyboard dates back to 1878! This may mean that trying to design optimized character keyboards is not the right strategy. In my opinion, original text input methods which are not based on character key presses and exploit the intrinsic characteristics of handheld devices are much more preferable. For example, methods like SHARK [11], renamed ShapeWriter, EdgeWrite [10] or UniGlyph are really innovative and more interesting than QWERTY-like keyboards.

Moreover, text entry methods are language dependant. Many French words use an accent, which marks the pronunciation and meaning of the word. There are 27 French letters with diacritics (accent, cedilla). It is not realistic to design an input method without providing accents, either from the input or during the lexical prediction. So, corpus must be available in different languages to reflect the specificities of each language.

Last comment, I think it is important that text entry methods for able-bodied users should be designed from the outset to be adaptable to motor-impaired users. It would also be necessary for researchers in text entry for mobile devices to work with those in AAC.

References

[1] Belatar M., Poirier F. Glyph2PPC: A reduced onscreen keyboard for text input on PDA. *Proc. Human 07* (2007).

[2] Belatar M., Poirier F. Text Entry on Mobile Devices for Users with Severe Motor Impairments: HandiGlyph, a Primitive Shapes Based Onscreen Keyboard. *Proc. ASSETS 2008*, ACM Press (2008).

[3] Guerrier Y., Baas M., Kolski C., Poirier F. Comparative study between AZERTY-type and K-Hermes virtual keyboards dedicated to users with cerebral palsy, *Proc. HCI Int. 2011*, Springer (2011).

[4] MacKenzie, I. S. Soukoreff, R. W. Text entry for mobile computing: Models and methods, theory and practice. *Human-Computer Interaction*, 17 (2002).

[5] Poirier F., Schadle I. Interfaces réduites pour l'entrée de texte. État de l'art et présentation du communicateur Sibylle pour l'aide à l'écriture de personnes handicapées. *Revue RIHM*, 6(2), 2005.

[6] Poirier F., Glyph: A New Stroke-Alphabet for Stylus-Based or Key-Based Text Entry, *Proc. HCI Int 2005*, Springer (2005).

[7] Poirier F., Belatar M. UniGlyph: only one keystroke per character on a 4-button minimal keypad for key-based text entry. *Proc. HCI Int 2007*, Springer (2007).

[8] Wandmacher T., Antoine J.-Y., Departe J.-P., Poirier F. SIBYLLE, an Assistive Communication System Adapting to the Context and its User, *ACM Transactions on Accessible Computing*, vol.1, issue 1, ACM Press (2008).

[9] Wigdor, D. Balakrishnan, R. A Comparison of Con-secutive and Concurrent Input Text Entry Tech- niques for Mobile Phones. *Proc. CHI'04*, ACM Press (2004).

[10] Wobbrock, J.O., Myers, B.A. and Kembel, J.A. (2003). EdgeWrite: A stylus-based text entry method designed for high accuracy and stability of motion. *Proc. UIST '03*, ACM Press (2003).

[11] Zhai, S. and Kristensson, P.O. (2003). Shorthand Writing on Stylus Keyboard. *Proc. CHI 2003*, ACM Press (2003).